



RESEARCH DEPARTMENT



REPORT

**Vertically-polarized light-weight
u.h.f. aerials for site testing**

No. 1969/32

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**VERTICALLY-POLARIZED LIGHT-WEIGHT U.H.F. AERIALS FOR
SITE TESTING**

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VERTICALLY-POLARIZED LIGHT-WEIGHT U.H.F. AERIALS FOR
SITE TESTING

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VERTICALLY-POLARIZED LIGHT-WEIGHT U.H.F. AERIALS FOR SITE TESTING

SUMMARY

A series of light-weight aerials has been produced for use in testing sites for u.h.f. relay stations. The aerials are vertically polarized and suitable for attachment to a small balloon.

1. INTRODUCTION

Site testing for u.h.f. relay stations has usually been done by erecting a test transmitting aerial on a 48.8 m (160 ft) light stayed mast. A new method, now proposed, which is more economical in manpower, is to support the aerial with a small balloon; this also allows changes in the height of the test aerial to be made more quickly. The balloons envisaged are of 7.08 cu m (250 cu ft) capacity and are also required to support the transmitters, so that the maximum permissible weight of the aerial is very small.

The specification of the aerials was as follows:

Frequencies of operation:	522, 666 and 756 MHz
Gain:	± 1 dB relative to a half-wave dipole
Impedance:	50 Ω
Polarization:	Vertical
V.R.P.:	Similar to a vertical half-wave dipole
V.S.W.R.:	Not less than 0.85
Weight:	Not greater than 0.45 kg (1 lb)
Mounting:	The aerial was to hang below the balloon and was required in turn to carry the transmitter.

A study of the requirements with regard to polarization and radiation patterns suggested that the Discone aerial¹ would provide the desired performance characteristics.

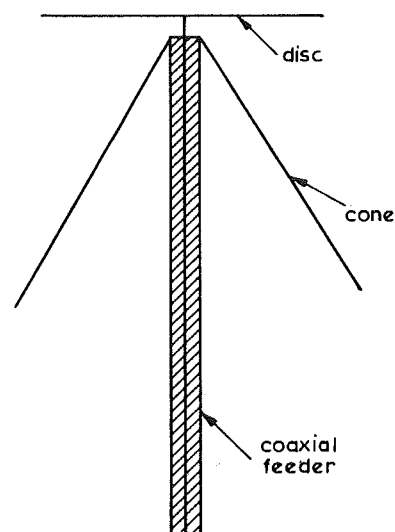


Fig. 1 - The Discone aerial

2. DISCONE AERIAL

The Discone aerial is shown in Fig. 1 where it can be seen that it is formed by replacing the top section of a biconical dipole by a disc. Its impedance characteristic is largely constant at frequencies greater than the frequency at which the slant height is equal to $\lambda/4$. Below this frequency the aerial is very inefficient. Above this frequency the impedance and radiation pattern characteristics are similar to those of a biconical dipole.

In reference 1 it is claimed that the Discone covers several octaves without substantial changes of input impedance or radiation patterns. It was hoped to cover the three test frequencies with just one model. However, radiation from the supporting tube was found to cause excessive irregularity of the vertical radiation pattern.

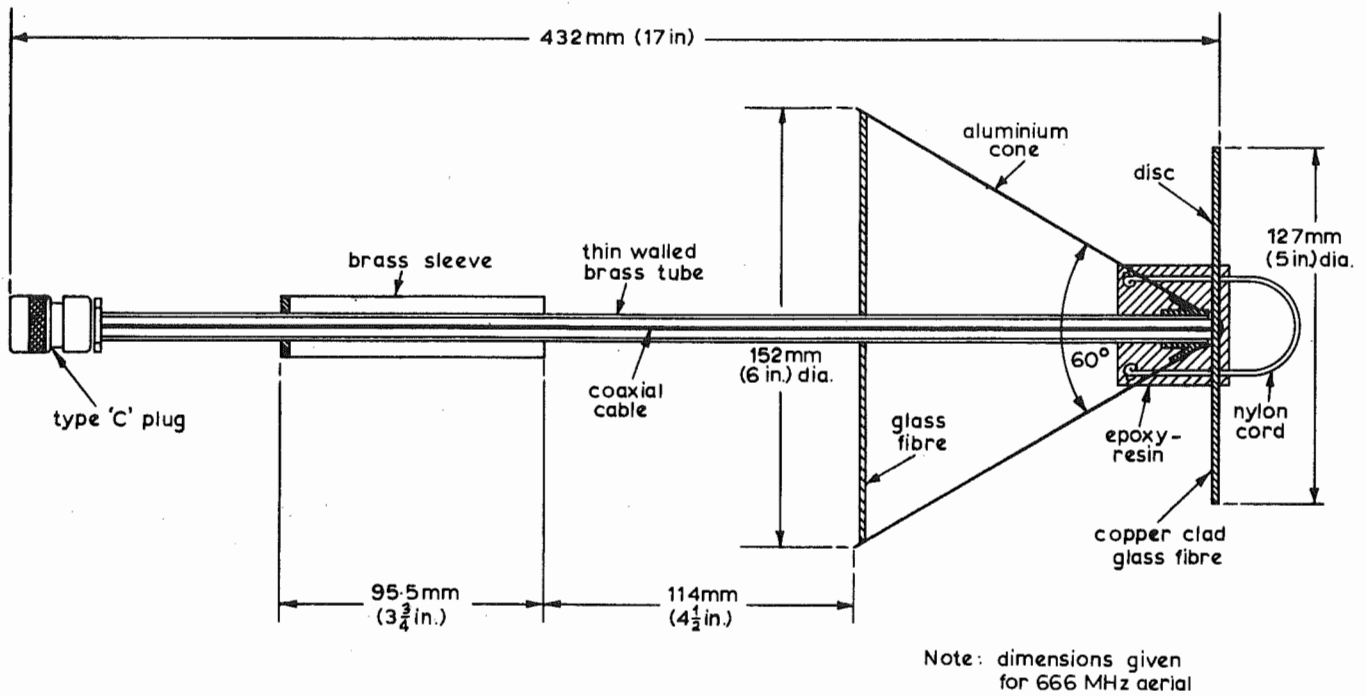


Fig. 2 - Construction of aerial

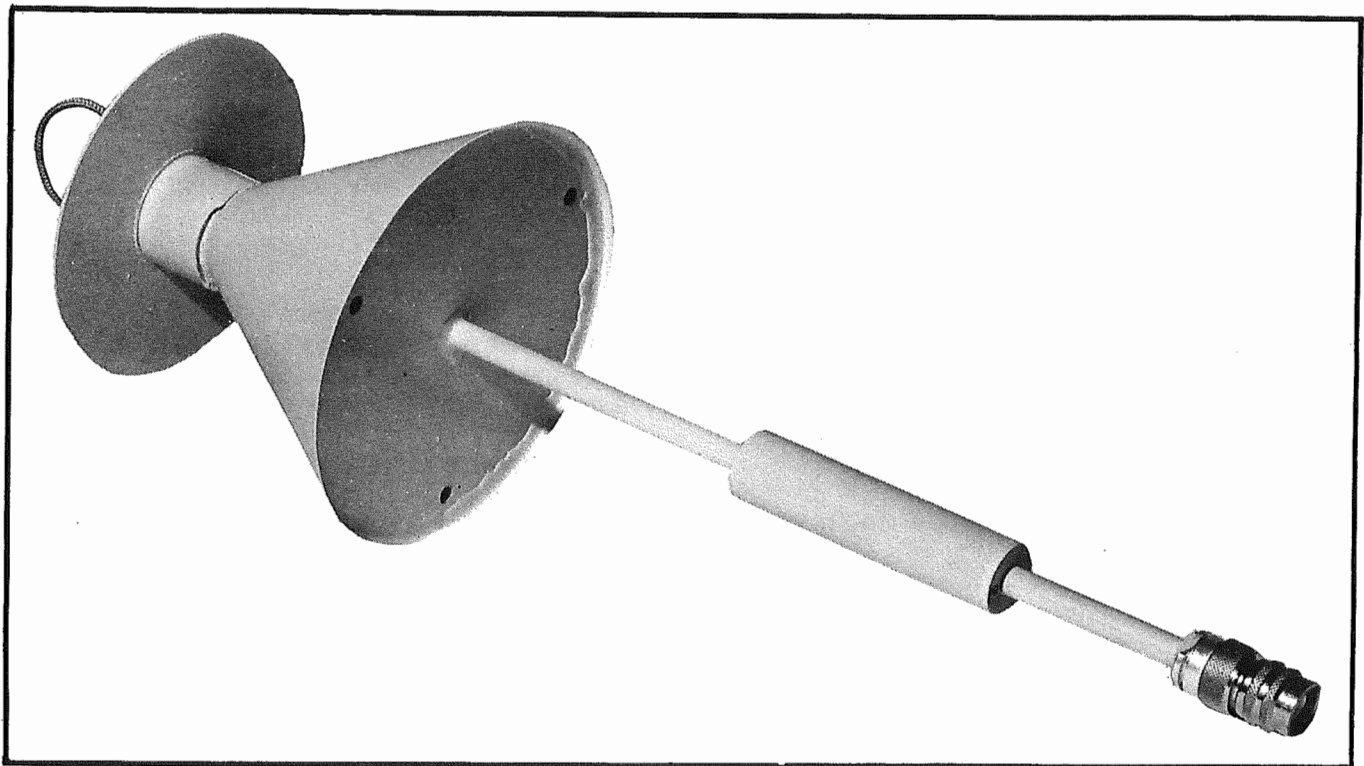


Fig. 3 - The completed aerial (666 MHz model)

The final solution was to employ a sleeve or choke on the supporting tube, but this is only effective over a limited bandwidth. Accordingly three models were made up, one for each of the test frequencies.

3. PRACTICAL DETAILS

The over-riding problem in the design of the aerals was the requirement for lightness combined with reasonable strength. The payload for the 7.08 cu m (250 cu ft) plastic balloons to be used is only 2.04 kg (4.5 lb) in still air (although this increases by kiting action in wind). The transmitters being used weigh 1.5 kg (3.3 lb), so a weight limit of 0.45 kg (1 lb) was set for the aerial.

The cone was made from 24 s.w.g. aluminium, the disc from 1.6 mm copper-clad glass-fibre laminate, and the supporting tube from thin-walled brass tube.

The open end of the cone was centralized and strengthened by using a disc of glass-fibre, and an epoxy-resin moulding was used for stiffening at the junction of the disc and the apex of the cone. A thin nylon cord was threaded through the disc and cone and moulded in with the epoxy-resin to form a loop for attachment to the balloon. The transmitter is connected directly to the aerial by means of a screw-lock type C plug and socket. The arrangement used is shown in Fig. 2 and a photograph of a completed aerial in Fig. 3.

For ease of identification the Discone aerals were painted in accordance with the RECMF colour code for domestic receiving aerals, namely

522 MHz: red, 666 MHz: yellow, 756 MHz: green

The horizontal radiation patterns of the aerals are circular. The three vertical radiation patterns are shown in Figs. 4, 5 and 6.

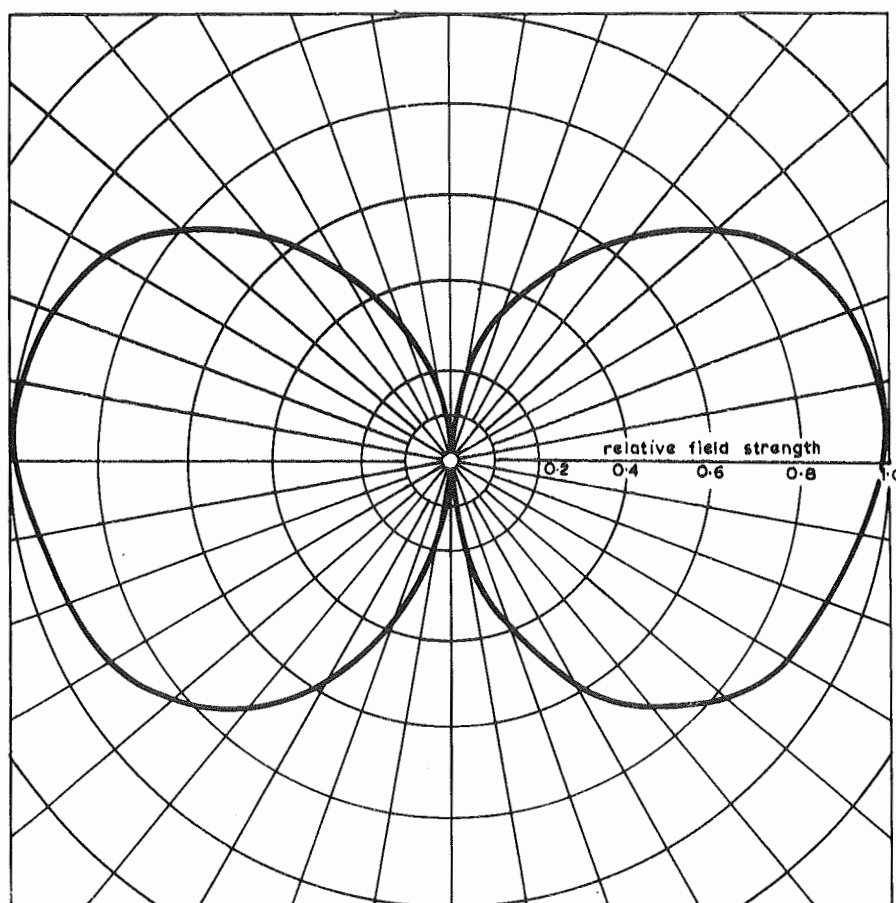


Fig. 4 - V.R.P. of 522 MHz aerial

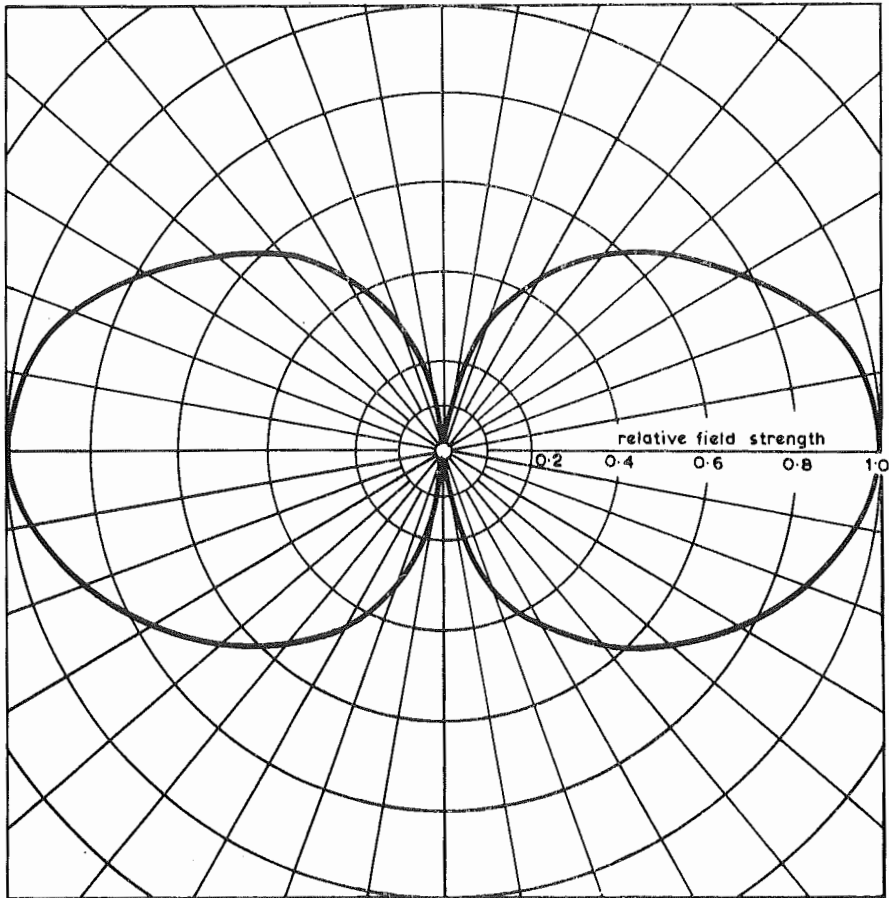


Fig. 5 - V.R.P. of 666 MHz aerial

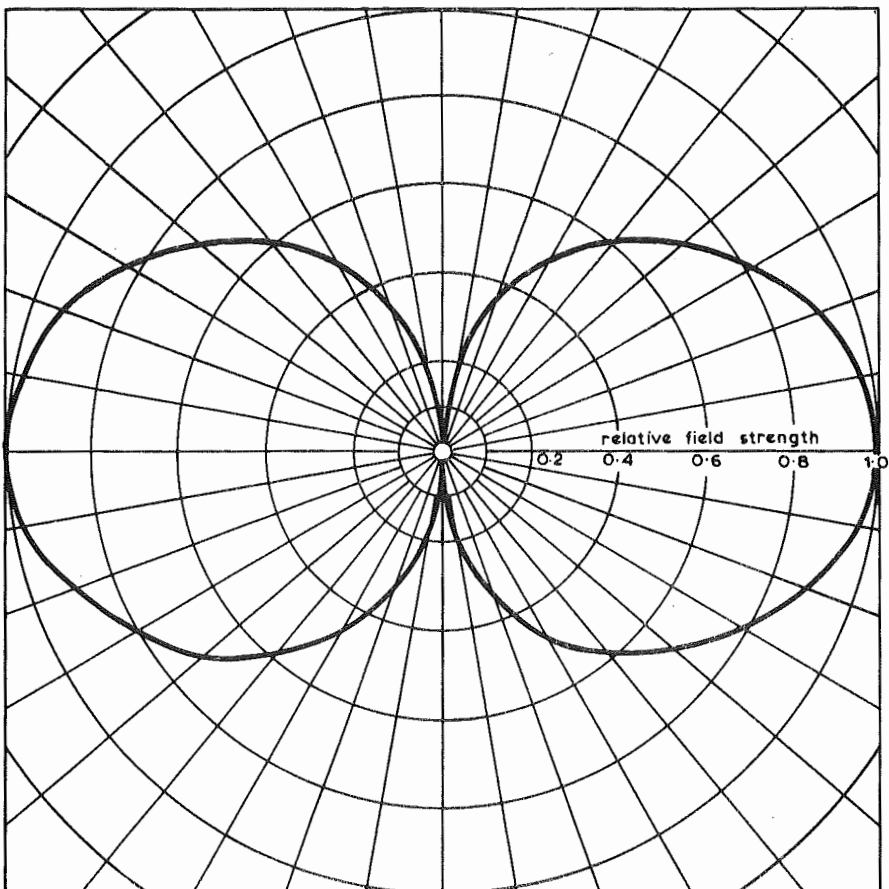


Fig. 6 - V.R.P. of 756 MHz aerial

The gains of the aeriels with respect to a half-wave dipole are as follows:

522 MHz	666 MHz	756 MHz
-0.5 dB	0.1 dB	-0.1 dB

The weights of the three aeriels are 0.45 kg (16 oz) for 522 MHz, 0.40 kg (14 oz) for 666 MHz and 0.37 kg (13 oz) for 756 MHz.

The v.s.w.r. is better than 0.9 for each model.

4. CONCLUSIONS

Three Discone aeriels have been designed for use as transmitting aeriels on u.h.f. site tests. The

mounting is arranged to fit directly on a small transmitter, and their light weights allow them to be supported by a small balloon.

5. REFERENCE

1. KANDOIAN, A.G. Three new antenna types and their applications. *Proc. I.R.E.*, 1946, 34, 2, pp. 70W-75W.

